

PAPER – DIESEL ENGINE SYSTEMS, Diesel Smoke

[Summary]

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The use of Diesel Engine Systems in underground coal mines is recognised as being 'high risk'. The consequences of ineffective controls in the use and maintenance of Diesel Engine Systems may be;

- Catastrophic failure resulting in a methane (and/or coal dust) explosion or a fire in a mine.
- Traumatic injury resulting in significant harm to persons
- Long term harm from the emissions from diesel engines resulting in significant harm to persons

Of particular concern as a risk factor is the emission of diesel smoke (DPM – Diesel Particulate Matter) from diesel engine systems operating in the limited ventilation in mines.



In Australia from 1991 very important research and testing was undertaken sponsored by BHPB and ACARP with Mr Steve Pratt, (*Manager Technology and External Relations, BHP Billiton Illawarra Coal*), and Dr Brian Davies leading the research. This early research highlighted the extent of the issues and provided some measures to minimise the risks.

One of the outcomes of this program was the design, development and introduction of filters (See Photograph above) to remove much of the DPM from the exhaust gas stream and therefore minimise the potential for harm to persons. There were also improvements made to maintenance processes and procedures to reduce the quantity of harmful DPM.

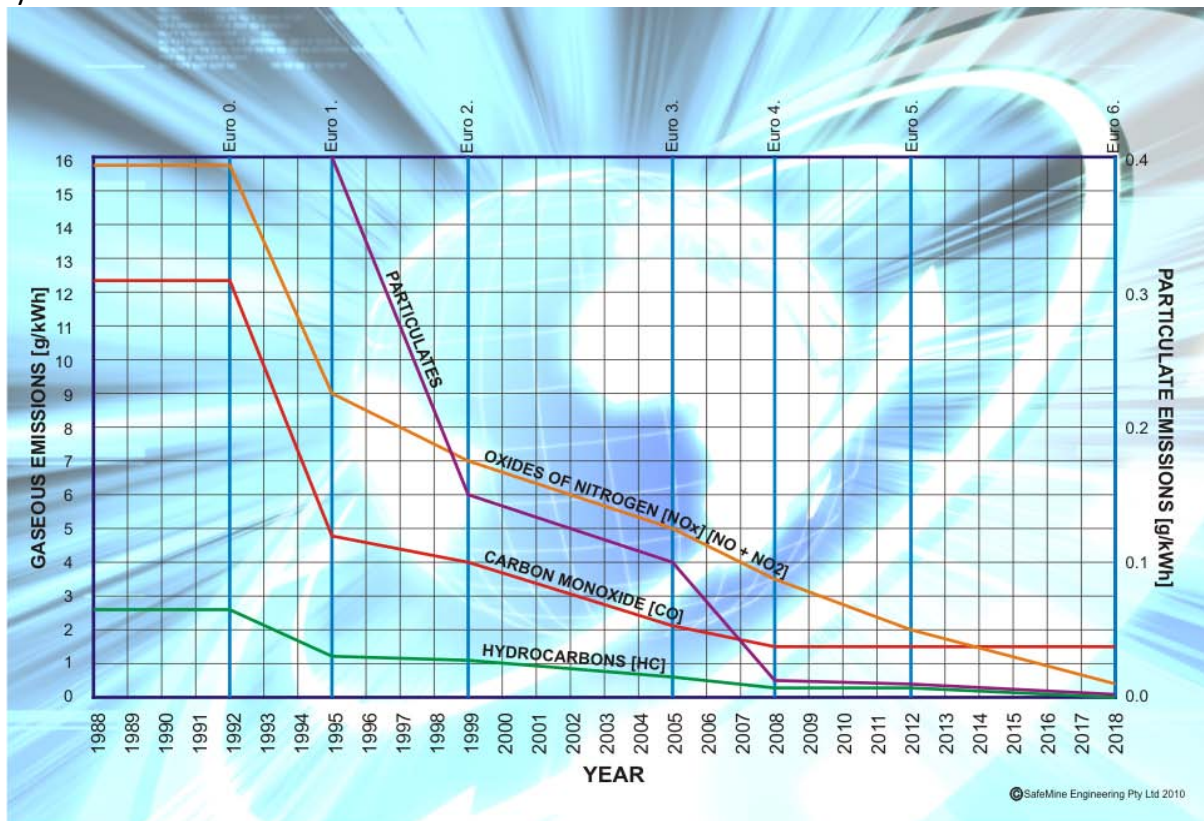
The implementation of controls for DPM and the increased application of new technologies have resulted in ongoing improvements. The Statutory Authorities in NSW and Qld have been at the forefront of encouraging and promoting the reduction of mineworker's exposure to DPM. In NSW a Guideline (MDG 29) was published in 2007. (The Management of Diesel Engine Pollutants in Underground Environments.) Compliance with the requirements of this Guideline by manufacturers and mines has resulted in continued improvements in the control of DPM.

We now have a very good understanding of the effects and controls required to manage the potential harm from DPM.

The World has helped our industry to reduce all harmful emissions including diesel particulates or smoke. There are mandated requirements for all of the manufacturers of diesel engines to reduce the emissions from engines.

In the USA, these requirements are mandated for all new engines and are known as 'Tiers'. In Europe the similar system is known as 'Stages'.

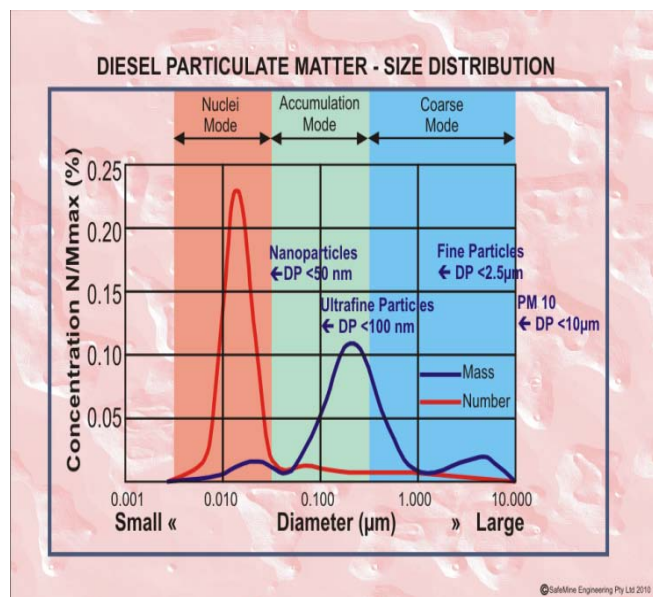
The graph below is a simplified summary of the European mandated requirements for the reduction of emissions for diesel engines. Australia is formally linked to the European system.



From the graph, it can be seen that the emission of DPM is being progressively reduced from 0.4 g/kWh to 0.02 g/kWh in the period from 1995 to 2018.

Diesel Particulate Matter is a complex issue that will require ongoing efforts and the application of new technologies to ensure that any potential for harm to persons is minimised. DPM is formed in the combustion process in three distinct sizes. Controlling the emission of nano particles (Nuclei mode on the graph – Right) is the current challenge for technology.

Fortunately the progressive adoption of Diesel Oxidation Catalysts (DOC) and the future use of Selective Catalytic Reducers (SCR) in underground mining engines will result in the even lower emission of DPM.



FOR DIESEL SMOKE – LESS IS BETTER